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THE INFLUENCE OF RAILROADS
UPON CAMPAIGN PLANS

A Monograph
by

Major Bradley E. Smith
Transportation Corps

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importance in campaign planning. The ability to maneuver is basic to any army, and the lateral shifting of forces on the battlefield in a timely fashion (which rail can do so well) is often critical to the success of a campaign. Wise decisions must be made now, taking a long-term and systemic approach to permit the maximum use of all available sources of transport, to include rail.

A first step toward that end is to determine how rail has been used in the past to apply operational art to campaign plans. This paper will examine railroad contributions to past wars in the areas of operational sustainment, maneuver, containment and deception. In addition, railroads are so valuable that, at times, they have assumed the characteristics of key terrain -- the control of track and roadbeds have themselves become the object of campaigns and tactical operations. This, too, needs to be explored. The objective is to review these past contributions, in light of present doctrine and current logistical requirements, to shed light on the applicability of rail to future wars.

Railroads have played a part in campaigns and as history has shown, their role has sometimes been the decisive one. Rail's potential contributions today are at least as great. Our military cannot afford to ignore these historic lessons. We should take whatever action is necessary now to ensure that sufficient rail capability is available and deployable when it is needed. And it surely will be needed.

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Campaign Plans

by

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School of Advanced Military Studies
U.S. Army Command and General Staff College
Fort Leavenworth, Kansas

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ABSTRACT

THE INFLUENCE OF RAILROADS UPON CAMPAIGN PLANS by Major Bradley E. Smith, USA, 63 pages.

Railroads have played an important part in wars throughout modern history. Today, the contributions rail can make to America's national defense include U.S. commercial rail help with mobilization of military units stationed in the United States. But their contribution would end at the ports of embarkation, because these commercial assets are not deployable, nor could they be spared at home. While this zone of the interior capability has strategic significance for the United States, rail has also great potential within the theater of operations, and that, we have left largely untapped. Unless rail units are added to the U.S. Army's force structure, this mode of transportation may remain a minor player in future military operations overseas.

Transportation capabilities are of fundamental concern to theater commanders. General George S. Patton, Jr., pointed out that road and rail networks are of paramount importance in campaign planning. The ability to maneuver is basic to any army, and the lateral shifting of forces on the battlefield in a timely fashion (which rail can do so well) is often critical to the success of a campaign. Wise decisions must be made now, taking a long-term and systemic approach to permit the maximum use of all available sources of transport, to include rail.

A first step toward that end is to determine how rail has been used in the past to apply operational art to campaign plans. This paper will examine railroad contributions to past wars in the areas of operational sustainment, maneuver, containment and deception. In addition, railroads are so valuable that, at times, they have assumed the characteristics of key terrain -- the control of track and roadbeds have themselves become the object of campaigns and tactical operations. This, too, needs to be explored. The objective is to review these past contributions, in light of present doctrine and current logistical requirements, to shed light on the applicability of rail to future wars.

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I. Introduction

Railroads have played an important part in wars throughout modern history. Today, the contributions rail can make to America's national defense include U.S. commercial rail help with mobilization of military units stationed in the United States. But their contribution would end at the ports of embarkation, because these commercial assets are not deployable, nor could they be spared at home. While this zone of the interior capability has strategic significance for the United States, rail has also great potential within the theater of operations, and that, we have left largely untapped. Unless rail units are added to the U.S. Army's force structure, this mode of transportation may remain a minor player in future military operations overseas.

Our military effort might receive rail support from foreign companies, if they are able and willing to help us. But that would depend upon sufficient indigenous rail infrastructure to meet the needs of our armed forces and their civilian population simultaneously. And we could rely on local rail only if the governments and indigenous people were supportive of our military objectives.¹ Even though our armed forces would probably receive sufficient host nation support in Western Europe,² that is not equally likely in all other parts of the world where U.S. forces may have to operate.

The United States military will, as it has always had to do, fight its future wars within the doctrinal framework of operational art, which the U.S. Army War College defines as "the employment of forces to attain strategic objectives in a theater of war or theater of operations through the design, organization and conduct of campaigns and major operations".³ Emphasis on operational art has increased since the 1982 version of Field Manual 100-5: Operations reintroduced the concept into our military literature.

The idea is not new -- it was employed particularly well in the War Between the States and during World War II. Operational art concerns the employment of military forces in a theater of war to accomplish strategic goals. Large unit operations need to be coordinated and tactical engagements sequenced to achieve desired results. Logistical considerations play an important role in operational art because they effect when and where U.S. forces can fight, and therefore, whether theater forces can accept or must decline battle.⁴

Campaign plans are the means with which theater commanders put operational art into practice. Operational art is theoretic and philosophic in nature. Campaign plans are more specific. They convert theory into a usable tool for commanders. Campaign plans provide coherent, long range approaches to defeating the enemy.⁵

Campaigns can be defined in various ways. Department of the Army Field Manuals 100-1 and 100-5 explain that a campaign is a "series of joint actions designed to attain a strategic objective in a theater of war".⁶ Field Manual 101-5-1 defines it as "a connected series of military operations forming a distinct phase of a war to accomplish a long range major strategic objective".⁷ And Joint Chiefs of Staff Publication 1 defines a campaign as a "series of related military operations aimed to accomplish a common objective, normally within a given time and space".⁸

Many of the U.S. Army's past operational achievements are logistic in nature, because our style of warfare emphasizes mass. For the same reason, logistics will continue to be especially instrumental in future wars.⁹ As much effort is needed to develop ways to supply combat forces as is needed to develop the new fighting doctrine itself. The importance of transport to large unit operations is great. The type and amount of cargo which can be distributed within a theater has a direct impact on the tempo of battle, axes of advance and determination of the main effort.¹⁰

Transportation capabilities are of fundamental concern to theater commanders. General George S. Patton, Jr., pointed out that road and rail networks are of paramount importance in campaign planning.¹¹ The ability to maneuver is basic to any army, and the lateral shifting of forces on the battlefield in a timely fashion (which rail can do so well) is

often critical to the success of a campaign. Wise decisions must be made now, taking a long-term and systemic approach to permit the maximum use of all available sources of transport, to include rail.

A first step toward that end is to determine how rail has been used in the past to apply operational art to campaign plans. This paper will examine railroad contributions to past wars in the areas of operational sustainment, maneuver, containment and deception. In addition, railroads are so valuable that, at times, they have assumed the characteristics of key terrain -- the control of track and roadbeds have themselves become the object of campaigns and tactical operations. This, too, needs to be explored. The objective is to review these past contributions, in light of present doctrine and current logistical requirements, to shed light on the applicability of rail to future wars.

II. Operational Sustainment

Large unit operations will quickly come to a halt without the required logistical support. Because modern equipment consumes so much bulk, especially repair parts, ammunition and petroleum, logistical demands are at an all time high. During World War II, it was estimated that every member of the U.S. Army needed six tons of supply initially and one ton every month afterward. With close to a million men in uniform,

supply requirements were staggering. Rail was the critical link in the transportation network at home and overseas to support our troops logistically.¹² Despite fewer troops involved, requirements are even more severe today. For example, an M1 tank division will consume over 600,000 gallons of fuel per day, which is double the amount that General Patton's entire Third Army consumed at the height of his race across Europe in World War II.¹³

Transportation shortfalls to move required tonnages are anticipated within the theater¹⁴ so the potential sustainment contributions of rail are as great at the operational level of war as they are at the tactical. Major General Albin G. Wheeler, Commandant of the Industrial College of the Armed Forces, calculates that five divisions will require approximately 350 to 400, 5,000 gallon tanker, loads to replace the petroleum consumed in a 50 kilometer attack. An additional 700 truck loads will be needed daily to keep the divisional basic loads replenished.¹⁵ Motor transport constitutes only a partial solution because the five division support commands have, under optimal conditions and assuming no attrition and maintenance failures, fewer than 150 transport vehicles (total) that can be used for distribution purposes.¹⁶ Because of the greater number of organizations involved without a proportional increase in assigned truck units, transportation shortfalls are magnified at higher

levels of command. And so will be the consequences of failing to correct these shortages.

Calculating transportation requirements in advance is no easy task. The amount of cargo to be hauled and distances involved are two factors to be considered. Lines of communication (LOCs) are expected to be extended on the modern battlefield -- in other words, long and vulnerable. Fronts will be nonlinear and fluid, with no clear delineation of friendly and enemy forces on the ground. Attrition of transportation assets will be another factor. The potential for intense, violent combat is the result of technological advances in weapon systems' accuracy, range and lethality. It will effect combat service support as well as combat units. Insufficient transportation resources are likely even at the outset of conflict and that which is available will be taxed severely and, perhaps, prove inadequate.¹⁷

The importance of logistics at the operational level of war was stressed by Mikhail Tukhachevskiy. This author commanded armies during the Russian Revolution and later became the Deputy People's Commissar of Defense.

The command group that has undertaken the operation and drawn up the operational plan but has not coordinated it with respect to logistics is criminal in its actions. A sound and proper operational plan can only be drawn up on the basis of all material resources, both in terms of armed forces and the logistical services. Hence the reason why all commanders should personally administer not only the operational concepts but the overall logistical side of the matter.¹⁸

The extent that railroads can contribute to operational sustainment depends in part upon the command attention they receive. Rail is an exploitable asset for theater commanders, even when only partially developed infrastructures exist within their areas of responsibility. Justifications for greater use of rail, based on capacity and economy,¹⁷ are too strong to ignore.

Historic Examples of Operational Sustainment

By the very nature of modern war, conflict will be accompanied by large scale sustainment efforts. Russell Weigley in his book, The American Way of War, points out that the first army ever to be sustained by rail over long distances, for extended periods of time, was the Union Army during the War Between the States. Federal troops invaded the South with the intention of staying, which meant their logistical plans had to be developed with a long-term, systemic approach in mind. This truly was operational art in practice.²⁰

Railroad capacity influences operational plans because modern armies can fight in a modern way only when they get the logistical support required to sustain combat and they cannot get that, even today, without extensive use of rail. This was the case in the Korean War where rail was the principal mode of logistical transport. Ninety-eight percent of all movement

of men and equipment north from the Port of Pusan was accomplished by rail.²¹ The rail system was better developed in the western part of the country and that was where most U.S. offensive operations -- with their large consumption of petroleum and ammunition -- occurred.²²

Another example of operational sustainment is the Red Ball Express in World War II. That operation was heralded as a major achievement but, in actuality, it was the result of poor planning and crisis management. Staff officers -- tactical and logistical -- at the highest echelons of the United States Army failed to anticipate the great success that was realized after our breakout from Normandy. American forces outran their supply lines in the course of pursuit operations. Arrangements were not made for trucks, railcars, train engines and track repair equipment to be brought ashore quickly enough to meet the demands after the breakout near Saint Lo in late July 1944.²³

Railway engineering companies had been programmed to arrive in France later to assist with maintenance of way operations. Reshuffling of ship stowage plans in England and the use of Army Corps of Engineers units already in Normandy assisted with the rejuvenation of roadbeds. Even with the Red Ball Express (which was the best trucking operation that could be made), theater transport assets were insufficient to permit a continuation of the offense. This resulted in an

operational pause for the Allies which gave the Germans a chance to establish prepared defensive positions.²⁴

The Red Ball Express resupplied U.S. First and Third Armies in Lorraine, France from depots located in the Normandy lodgment area. It provided an excellent opportunity to compare rail and highway capacities by examining an all out motor effort in contrast to ill-prepared rail activity. The Red Ball was functional from August to September 1944. At its peak, it used 132 truck companies (or 5,958 trucks) to deliver an average of 7,000 short tons (STONs)²⁵ daily over a 400 mile stretch of road. And extreme measures had to be taken to accomplish that, to include the stripping of trucks from three infantry divisions at English Channel ports. All that combat power was left stranded without wheels.²⁶

The Red Ball was inefficient in many ways. It led to a rapid breakdown in vehicle maintenance because Army tactical vehicles were not designed then (and are not now) to be driven long distances at high rates of speed. Time was not taken to conduct preventive maintenance and perform basic services. The trucks consumed 300,000 gallons of fuel daily -- about the same amount as an entire World War II field army. Numerous accidents occurred due to the hazardous driving conditions, driver fatigue and physical deterioration of roads.²⁷

The Red Ball Express delivered a total of 135,000 STONs during the two month period. In comparison, the railroads hauled in excess of 335,000 STONs the same approximate

distance for the month of September alone. Rail was clearly the mode of choice for reasons of capacity and economy. It could have been used even more had adequate preparations for rolling stock, prime movers and roadbed repair been made in advance.²⁸ One of the primary factors enabling the U.S. to resume the offensive in November 1944 was the relatively fast rehabilitation of the French railroads.²⁹

Section Summary

Operational sustainment is a major part of any campaign plan. Modern armies with sophisticated weaponry require vast quantities of petroleum and ammunition, not to mention the other classes of supply necessary to sustain life and keep military organizations running. The United States Army has spent considerable time, effort and money in modernizing its weapons technology and in creating new war fighting doctrine. It is questionable whether our sustainment base has received comparable attention and resources. Without the additional attention and resources, our logistic base may not be able to handle successfully the greater demands being levied against it. Transportation shortfalls in some theaters are expected.³⁰ The use of rail to support large unit operations is an old idea which still has merit. Railroads should play a larger part than they now do in our logistical infrastructure. They would significantly increase our

operational sustainment capabilities which, as they are now constituted, are probably inadequate for combat.

III. Operational Maneuver

A fundamental requirement of modern armies is the ability to maneuver, the essence of which is the "movement of forces in relation to the enemy to secure or retain positional advantage".³¹ Generally speaking, the larger the force, the more complicated it is to move, and the more difficult it is to sustain. Operational maneuver supports the theater commander's campaign plan by deploying his forces to favorable ground before the battle in order to retain or wrest the initiative from the enemy.³²

Contributions of rail to operational maneuver were recognized soon after their initial development. In 19th Century Europe, it was generally accepted that railways were a major source of national strength. This mode of transportation not only increased the rate at which countries could mobilize, but also added new meaning to a fundamental Napoleonic maxim -- "concentration of overwhelming forces at the decisive point".³³ That is how railroads revolutionized warfare, an early example of which is the Franco-Prussian War of 1870.³⁴

Massing strength continues to be of paramount importance to operational planners. Today, there are four primary modes

of mechanized transportation to aid in troop movement, compared to only one or two a 100 years ago. The role of railroads may therefore not seem as critical as it once was, because of the other available options.³³ But railroads still have a tremendous and absolutely essential contribution to make in future warfare. Despite the advent of motor and aerial transportation, railroads probably still must haul about the same proportion of supplies as they always have. (Compare today's rail, water, motor and air capabilities to yesterday's rail, water, wagon and manpack capabilities.) Trucks and airplanes contribute relatively little to the total wartime ton-mile requirements.

The Russian military writer Triandafillov devotes a significant portion of his book, Nature of the Operations of Modern Armies, to the role that rail plays in supporting successive military operations. He elaborates upon the limitations of vehicle transportation for Eastern European armies and how "the lateral movement of large forces during combat actions is possible predominantly by means of railroads".³⁴ He cites the overriding influence of specific rail lines in three chapters entitled "How to Move Large Forces Laterally in the East European Theater of Military Actions", "Face of Advancing Armies" and "Shock Army Requirements During Prolonged Operations". Triandafillov ties operational sustainment and maneuver together into a tightly knit relationship, and shows how a rail network -- to include

calculations in terms of number of trains, railcars and lines -- can meet the requirements of Russian commanders fighting what appear to be future enemies to the west.

Another aspect of operational maneuver deals with Helmuth K. von Moltke the Elder's belief that the "initial concentration and deployment of the field armies was critical".³⁷ In other words, a mistake in positioning forces at the beginning of the campaign is difficult to recover from throughout the remainder of the war. Even though there is a great deal of truth to this statement, it is wrong for us to seduce ourselves into focusing too heavily upon the first battle at the expense of follow on phases of the campaign.³⁸ Hard questions about the movement of large units, by rail and other means within the theater, need to be wrestled with in advance. Failure to take a long-term, systemic approach will result in war plans that are too shallow to meet the requirements of protracted war.

At the operational level, commanders cannot concentrate their forces to fight, maneuver to avoid combat or reap the benefits of successful tactical actions unless their corps and divisions can move quickly, securely and efficiently.³⁹

Operational maneuver and railroads impact on campaign plans in other ways. Winning organizations have to be more agile than their opponents to capitalize upon available opportunities. Agility is as much a state of mind as it is

physical in nature.⁴⁰ And that agile state of mind must include the ability to apply all resources to the problem at hand. For the logistician, that means heavy emphasis on rail.

Lieutenant Colonel Lawrence Izzo, in his analysis of Manstein's campaign on the Russian front, draws some conclusions about the agility of present day U.S. Army forces. He argues that the introduction of new M1 tanks and M2/M3 infantry/cavalry fighting vehicles have resulted in greater tactical mobility, but this has not translated into greater operational agility.⁴¹ Divisions are only as fast as their slowest vehicles and only that fast when supplies can keep up. Another study came to essentially the same conclusion.

One factor that becomes apparent when comparing World War II operational moves to modern operational movement planning is that the modern Army of Excellence division or corps is no faster than its World War II counterpart.⁴²

It can be argued that our divisions and corps are not much quicker than Stonewall Jackson's forces which moved about 20 miles per day during the War Between the States. Even light resistance on the battlefield today can cause mechanized infantry to dismount, which determines the rate of march of all behind them. The way to speed up the operational tempo is to go where there are enemy weak areas. That requires

flanking movements and, if done on a large scale, will require the use of rail.

Another factor that impacts upon agility is the sheer size of the organizations we are dealing with now. U.S. corps today are considerably larger than their World War II counterparts. Today, the road space taken up by a heavy division's organic vehicles exceeds 700 kilometers.⁴³ And demands upon railroaders have increased proportionately. Approximately 1200 flatcars and gondolas with the ends removed were necessary to transport a World War II American division. More than double that amount of rolling stock is necessary to move a modern division.⁴⁴

Lieutenant Colonel Izzo makes other observations about things which impact on U.S. Army agility. First, combat forces cannot be weened from their reliance upon combat service support for reasons discussed earlier. This has tied the fighters to the speed of corps and division support commands (DISCOMs). Second, these logistical organizations take longer to relocate than one might suspect, because they lack the organic transportation to move themselves and their supply stockages in one lift. Third, the growth of staffs to process and interpret the proliferation of information coming into headquarters also stifles rapid decision making.⁴⁵ Railroads offer partial remedies for the first two problems that Izzo raises which deal with physical agility. (The third observation deals with mental agility which rail can

stimulate.) Trains allow combat forces and their support slices to move together over long distances. They also permit the large scale displacement of corps support commands and DISCOMs in fewer lifts.

Synchronization of combat power is another characteristic of successful armies. It always has been a challenge for large unit commanders to muster their resources at the critical time and place, so the combined effects of weapon systems and manpower can be brought to bear on the enemy. Coordination of firepower is usually associated in one's thoughts about synchronization, but the concept encompasses much more. Synchronizing forces by maneuver is equally critical if local superiority is to be achieved. Both aspects are especially important for armies that are fighting outnumbered -- a likelihood which exists for the United States in future high intensity conflicts. Forces as well as operational fires need to be concentrated at specific, advantageous, points on the ground. Reserves also must be shifted as the situation dictates.

Operational maneuver, agility and synchronization are dependent, to a great extent, upon the physical resources available to a theater commander. Regardless of how inspired the leader, and how competent his staff, a basic requirement for success is adequate transportation resources at hand. Optimal mixes of all modes of transportation -- motor, inland

waterway, air and rail -- will have to be put to good use by the theater army staff to meet the challenges that lie ahead.

Comparison of Motor and Rail Contributions to Operational Maneuver

Comparisons of motor and rail transport are based on myriad factors: availability of roads/track from origin to destination, physical condition of roads/track, availability of vehicles/rolling stock and the availability of vehicle teams/rail crews. The required delivery date, distance to be traveled and the cargo cube and weight have a major bearing on the mode selection.

Movement of military forces by motor vehicle, although sometimes dictated by the tactical situation, has numerous disadvantages. Road deterioration and traffic congestion are two consequences. The heavy use of roads, particularly by tracked vehicles, will destroy any surface, regardless of construction. So, tracked movement over hard surface roads should be kept to a minimum and reserved for times of operational necessity. Once the road network deteriorates, combat service support vehicles, which are primarily restricted to roads, will have great difficulty resupplying combat forces. Traffic congestion is a factor too. Large units moved by road will invariably interfere with, if not stop altogether, resupply efforts by other units in theater.

Lateral shifting of forces across a theater is certain to cross a main supply route at some point.⁴⁴

The amount of time and road space it takes to move large units is considerable. For example, an armored division has approximately 5,100 organic vehicles, but this number increases to almost 6,000 when the corps artillery and engineer units are attached. These vehicles tie up over 900 kilometers of road space. The distances reflect optimal conditions -- they are based solely upon mathematical calculations and do not include complications due to refugee traffic and interference from road use by other friendly forces. March tables for large unit moves are inherently sensitive and can easily be thrown into chaos. If an unauthorized party decides to use the road, or if an authorized unit is early or late for their start time or critical points, repercussions reverberate from that point back.⁴⁵

Congested roads pose an inviting target for enemy air forces, particularly when traffic is backed up. Although night moves help increase security, blackout driving results in extremely slow progress and adds to the confusion.⁴⁶ The speeds at which trains move, on the other hand, are affected little by darkness and adverse weather.⁴⁷

Road movements by large forces are known for their massive fuel consumption and delays enroute due to refueling operations. Maintenance breakdowns are common if long

distances are involved, because tactical vehicles, tracked and wheeled, do not stand up well in these conditions. Those which do make the entire trip have decreased time before they require another lubrication or service. Unless this maintenance is performed, the machines are of questionable reliability in combat later. And more problems are almost certain to occur because the U.S. Army rarely practices disciplined road movements above brigade level.

Generally speaking, the greater the distance to be traveled, the stronger the case for rail. For example, it might take an army corps a week to complete a given road march, compared to only a day or two by rail. (The difference in time may be critical for the operational commander.) And by using trains, the troops would arrive well rested and the equipment in an operational condition. This assumes plans are carried out with optimal results in both cases.⁵⁰ But the use of trains to move military forces short distances may actually take longer than road marching. Somewhere in between, a decision point exists.

One approach is to draw the line for passenger movements at 75 miles. European mass transit authorities have found this rule of thumb to reflect the most efficient approach to transporting large numbers of people. Similarly, the bulk transport of freight is most cost efficient when hauling in excess of 300 miles. This distance drops dramatically depending on the commodities carried and proximity of

consignees to industrial rail sidings. The efficiencies derived from containerized cargo also reduce the distance at which a decision point is reached. War, of course, is too complex to abide rigidly by such simple rules. Decisions will need to be based upon peculiarities of the situation. Considerations that have overriding influence in wartime could bear little weight in peacetime. But the point remains that ways do exist to determine when the rail movement of men, equipment and supplies is the best alternative for theater commanders. Developing the methodology, however, is beyond the scope of this paper.

Many of the decisions to road march or use rail can be made prior to any declaration of war. Distances from allied cantonment areas in Western Europe, for example, to general defense positions (GDPs) are cases in point. Trains are a viable option when the speedy arrival of combat forces at their GDPs is critically important to forward defenses. It may be determined that, in many instances, rail is the ideal way to transport men and equipment from ports or POMCUS (pre-positioning of materiel configured to unit sets) sites to forward assembly areas. In these cases, detailed arrangements can be made now to ensure that railcars are available when and where they are needed. Whatever decisions are reached, repercussions need to be thought through. Troop dispositions at the commencement of hostilities will have ramifications

throughout the entire conflict. Moltke the Elder made this point years ago.

Rail permits a greater degree of dispersion to protect against air threats and nuclear attack than do road marches. Large units may be broken up and assigned different railheads along one or more main lines. Engineer units can quickly build temporary side or end ramps if none already exist. Train schedules can be designed so high priority units arrive at their destinations first in accordance with campaign plans.

The use of rail allows commanders to maintain unit integrity, which is sometimes lost during convoys due to maintenance breakdowns and missed start times (which can result in a unit not being given permission to move until much later). The loss of fighting vehicles along a convoy route can seriously impact upon the execution of battle plans. Command and control challenges become more complicated when combat units arrive piecemeal. Keeping the men, equipment and supplies together -- aboard the same train -- will enhance the units' ability to perform their wartime missions.

Rail can solve other problems which can result from operational maneuver. Coordination is required between allies when transiting those portions of the theater under foreign control. Field services and maintenance support by our allies for American forces on the move may not be possible, because sustainment is considered to be a national responsibility.³² To alleviate many of the potential

problems that might arise during road marches, our men and equipment could be moved by train as self-contained and self-supporting packages.

Historic Examples of Operational Maneuver

The first recorded use of operational rail occurred in 1846 when the Prussians moved the Sixth Corps, consisting of 12,000 men with their horses and equipment, to seize the Republic of Cracow.²³ Later the same year, the Russians moved a 14,500 man corps 200 miles, in two days, from Hradisch to Cracow.²⁴ In 1859, rail was used to assist with the mobilization process in the Franco-Austrian War. French troops were shipped from Genoa directly onto the battlefield near Montebello.²⁵

During the Seven Weeks War in June and July 1866, Moltke the Elder deployed the Prussian Army over five separate rail lines compared to the one his Austrian opponents used. It proved to be a mistake because he violated the principle of mass. Prussian armies were spread across a front that extended over several hundred miles of frontier. Nevertheless, Moltke was quick to see the potential value that railroads would play in future wars. He went on to defeat the Austrians at the Battle of Koniggratz. He successfully used rail in the Franco-Prussian War of 1870 to defeat the French.²⁶

One of the spinoffs from the Prussian campaigns in 1866, 1870 and 1871 was "railway sections soon became the most prestigious single department of general staffs everywhere".⁵⁷ Their staff work was recognized as painstakingly difficult. There was increased reliance on exact details that demanded accuracy in time and space calculations -- load/offload operations had to be coordinated throughout the command, rail capacities maximized and congestion throughout the network minimized.⁵⁸ The nature of such work today is essentially the same as it was a hundred years ago, perhaps even more difficult for the U.S. Army, since we employ so few personnel experienced in rail operations and therefore have so little expertise.

Indeed, trains have played a leading role in the mobility revolution that has been occurring in modern warfare since Napoleon's time. The influences of time and space upon modern strategy has never again exerted the same constraints since the introduction of the railcar.⁵⁹ Railways became the "accelerator of 19th Century warfare" from the standpoint of mobility⁶⁰ and caused military staffs to view their war plans in an entirely new light. And when movement of truly large mass is at stake, they can play the same role today.

In the period prior to World War I, Count Schlieffen, Chief of the German General Staff, developed a plan for the conquest of France. He recognized the need for a quick victory before Russia, the probable ally of France, had time

to mobilize completely. The Count envisioned an invasion of Belgium and Luxembourg using speed and audacity, followed by German forces sweeping to the north of the French fortress system between Verdun and Belfort. The Germans would conduct a wide turning movement around Paris, eventually encircling the city. It was believed that France would then have to capitulate. Then attention could be focused upon the Russian threat. Schlieffen understood that railroads would have to play a key role in the execution of his plan.⁴¹

Colonel-General Helmuth J. von Moltke the Younger was the one to implement his predecessor's plan. Correlli Barnett's book, The Swordbearers: Supreme Command in the First World War, criticizes both Moltke the Younger and Schlieffen for not thinking "operationally in terms of railways".⁴² The German plans made no mention of the French railways as a strategic objective.⁴³ Little consideration was given to the lateral rail movement of soldiers. During the execution phase, German forces were spread from Picardy to Switzerland, with no means of mass transport linking them, except by long distance detours through the city of Aachen by rail.⁴⁴

Even despite such inadequate planning, rail was still so important that it finally played a key role in the execution of the Schlieffen Plan. The plan's success depended in part upon the immediate seizure and subsequent use of Luxembourg's railways.⁴⁵ This rail network was needed to transport German soldiers west across conquered territory on four main

trunk lines -- 180 trains allocated to each army corps.** Moltke later deviated from the Schlieffen Plan, in part, because of considerations given to the French Army's dependence upon railroads. Before the German Army could completely encircle Paris, the Chief of the General Staff assigned new missions and axes of advance. The new instructions directed marches southward to attack French forces that were southeast of Paris. This action would cut rail lines of communication running east and southeast from the capital, which the enemy army needed for sustainment. (An example of rail as an operational objective.) But what the Germans failed to anticipate was the Battle of the Marne.**

In World War II, during the Battle of the Bulge, four divisions of the U.S. Third Army, including their logistical support, were moved by rail laterally behind the front and detrained at railheads in the southern portion of the bulge. Also in December 1944, another division from the U.S. Seventh Army was brought to the battlefield by rail and went straight into combat. The entire operation that transported five divisions took less than 48 hours in heavy snows. Throughout the battle, artillery ammunition was delivered to firing positions, which were established adjacent to railroad tracks, thereby avoiding costly time delays which would have resulted from transloading to trucks. This is another example in which railroads heavily influenced operational maneuver and sustainment.**

The German Second SS Panzer Division's breakout from the Veszprem, Hungary railhead is an example of both tactical and operational uses of rail. In March 1945, the majority of the Hungarian Third Army deserted in the face of their Russian enemies, leaving a large gap in the Eastern Front immediately north of the Third SS Panzer Division (vicinity of Kisper, Hungary). The Sixth SS Panzer Army Commander shifted the Second Division by rail from its position on the lines near Veszprem (which was immediately south of Third Panzer), north to plug the gap created by the fleeing Hungarians. The Ninth Panzer Division covered the Second Division's withdrawal to the railhead.♦♦

Even though the trip north from Veszprem was only 60 kilometers, using rail to shift forces laterally across the theater was faster than road marching. Speed was of paramount importance for the Germans. Loading operations continued even though the Russians were several kilometers away, breaking through to the railhead as the last train pulled away. The Second Division arrived at its destination in time to redeploy and prevent, at least for the moment, the Russian breakthrough.

Section Summary

Operational maneuver is one of the basic requirements for any army. It is so important that every possible means to

improve our maneuver capabilities should be explored now. We can expect our opponents to shift forces to achieve positional advantages. We must be able to do the same. Rail has been used successfully in the past by our own and other armies to exercise operational maneuver and to assist with agility and synchronization. Railroads possess inherent advantages over motor transportation. Logistic officers must make their theater commanders aware of these considerations about the use of rail.

IV. Operational Containment

Tukhachevskiy, in 1931, began writing about the dilemmas then facing Russian war planners. One of their challenges was how to avoid, in future conflicts, the massive frontal assaults that had occurred in World War I. Tukhachevskiy realized that armies with millions of men would spread out for hundreds of miles. He also believed that, as nations square off against one another, convenient flanks subject to attack would no longer be available. Alternative means to achieve decisive victory would be needed, and rail was one consideration to which he turned.

Even though both sides in World War I tried to nail down their enemy along the entire length of front, few restrictions were ever placed on the enemy in depth. Opposing sides were free to use railroads to shift forces and materiel as

necessary to strengthen weakened defenses or mass for a counterattack. Tukhachevskiy proposed that in future wars, the enemy should be contained in his movement, not only at the front, but throughout his rear area. He thought this can be achieved, in part, by using airborne landings to "seize and destroy railways" and create "deep barrier zones" within the enemy rear. Disruptions such as these would throw the opponent into confusion and draw his focus away from the front.⁷⁰ These writings were the forerunner of what the U.S. Army currently labels "deep attack", and it is interesting to note that Tukhachevskiy's thoughts were centered around logistical targets, especially rail -- testimony to its importance.

Operational containment includes attacking the opponent's freedom of maneuver by bombing key rail centers and track. In addition to delaying troop movement and resupply, it cuts off raw materials to heavy industry, however temporarily. Tukhachevskiy believed that attacking key industrial targets directly would be a mistake because they were likely to be protected by antiaircraft fire.⁷¹ Rail lines today are critical to the national security of most industrialized countries, including the United States.

Operational containment should be a consideration in developing a theater commander's scheme of maneuver. In setting favorable terms for engagement with the enemy, flanks can be created by breaking through enemy formations and

exploiting these penetrations to turn enemy forces. Rail can assist in this process by implementing a modern version of Napoleon's maxim of "advance separately, fight together". Tukhachevskiy interprets this as "deep echeloned movement over the nation's entire railway network" to set the stage for the execution of campaigns and conduct of war.⁷²

Section Summary

Operational containment may be part of the theater commander's vision in setting terms for the next battle. The concept can be put into action and produce tangible results for us at critical times and places. Destroying key portions of the enemy's rail network can be coordinated with other attacks and be synchronized to produce a maximum effect. Even though the damage done to his railroads is temporary,⁷³ an opponent's ability to move forces en mass and sustain them can be reduced at the critical moment, which may offer significant tactical opportunities. And consideration of the principle of containment underscores the need for our own theater commanders to protect their rail lines too.

V. Operational Deception

Throughout history, theater commanders have successfully incorporated railroad operations into their deception plans.

Rail has been used to conceal troop movements and the buildup of supply depots. Some critics today are skeptical about the whole idea of deception. They believe modern, sophisticated intelligence equipment has made subterfuge a thing of the past. They also point out that the time and effort put into deceiving an enemy are sometimes more costly than the benefits derived warrant. Commanders need to sort through these considerations and make their own decisions, but the point remains that a successfully executed deception plan is a combat multiplier.

During World War II, the British camouflaged their engines and rolling stock to blend in with vegetation. Disguising cargo was important, for if German pilots could be convinced the train was hauling coal, they would attempt to destroy the engine but not the cars. So, flatcars and hoppers carrying military equipment and supplies were made to look like coal cars. Wood and canvas mock-ups were built and painted black. Protruding tank turrets had coal camouflage netting draped over them.⁷⁴ Coal stockpiles in railyards were not the target of air attack and provided the foundation for cargo deception.⁷⁵

An example of a deception plan that keyed on railroads occurred in Manchuria at the end of World War II. The Russians at this time were making their move to seize territory -- Korea, the Kurile Islands and Sakhalin. The Russians achieved strategic surprise over the Japanese in

August 1945 by enforcing strict operations security and concealing the true extent of troop movement and materiel stockpiles. Russian trains began to operate at night across the Trans-Siberian Railroad as early as January 1945.

Camouflage covers were spread over hundreds of kilometers of roadbed during the day. Cargo was immediately dispersed once it reached its destination. In June and July, 22 to 30 trains daily pulled a total of 136,000 railcars eastward. Although 40 Russian divisions actually deployed, Japanese intelligence believed only 12 to 20 divisions had been relocated. The Japanese had a false sense of security, believing the Russians were not strong enough to attack when they did. The railroad deception helped to deceive Japan's intelligence as to the scale, location and timing of the Russian attack.74

Section Summary

Successful deception plans are one way to achieve surprise and reap the benefits that ensue. Rail operations have been tailored to deceive the enemy in the past and have proven to be successful. Operational deception has potential application in the future.

VI. Rail as Key Terrain

Rail networks -- by their very existence -- can have a major impact on the development of campaign plans. Track can take on characteristics of key terrain⁷⁷ and can be a major consideration in the selection of operational objectives in the offense. There have been wars that centered around rail lines because they were the primary logistical lifelines within the theater. There are portions of the world today where the same situation may arise again. It is clear in cases such as those that logistics not only sets the rate of advance, but also, the "distribution (of supplies) sets the vectors of the advancing front".⁷⁸

The Russo-Japanese War of 1904 is a case in point. Even though Japan sought the destruction of Russian warships at Port Arthur and her Baltic fleet in the Straits of Tsushima,⁷⁹ the land battle focused around the rail lines in Manchuria. Stakelberg's Imperial forces struggled with General Oku's Japanese 2nd Army in the vicinity of Wang-Fang-Kou, about 135 miles north of Port Arthur. Both sides maneuvered in close proximity to the track, many times fighting along railroad embankments.⁸⁰

Operational art in the Russo-Japanese War was limited to a series of locally orchestrated encounters -- cutting rail and telegraph lines, shifting forces up and down the track, seizing stations, destroying supplies, trains and track during

retreats, and effecting subsequent repair by advancing forces.¹¹ The fighting reached its height of intensity at the Battle of Mukden, along the Chinese Eastern Railroad. That turned into a shoving match up and down the track until the Russians capitulated.¹²

Colonel T.E. Lawrence of the British Army in World War I, unified and led Arab tribes in uprisings against the Turkish Army in what is today Saudia Arabia, Jordan, Israel and Syria. His exploits were primarily targeted against Turkish rail operations in conquered Arab lands. Colonel Lawrence conducted guerrilla raids on rail centers, tracks, bridges and train stations which the enemy used as supply centers. Unlike his Turkish opponents, Lawrence did not restrict his own movement to rail tracks and roads. But he attacked them because he recognized their importance. Lawrence used the desert to his advantage. It masked his approaches and withdrawals, allowing him to travel most of the time undetected by the Turks.

Colonel Lawrence's superior, General Sir Edmund Allenby, commanded the conventional British forces in Arabia. Allenby too went after rail centers. He sent his Desert Mounted Corps on a deep strike mission behind Turkish lines to seize key rail junctions, bridges and centers such as Aleppo during the Palestine Campaigns.¹³ Lawrence worked closely with General Allenby and the coordinated efforts of conventional and

unconventional warfare led to the successful execution of Allenby's campaign plans.■

At the beginning of World War II, Hitler refused to listen to his generals about the importance of railroads. As it turned out, not only would the primitive and largely dirt roads in Russia not support German forces -- particularly after the autumn rains began falling -- but the importance of Moscow as the nation's rail center was not given proper consideration until it was too late. Whoever controlled Moscow also controlled the rail lines west of the Ural Mountains, where most of the Russian population and industry was located. Army Group Center with an axis of advance to Moscow, was not assigned the main effort until after Hitler realized his error. By then, however, their enemy had built defenses around the capital city. Russian partisans recognized the importance of railroads by making them the target of choice for their guerrilla attacks. "The most vital military objective on both sides on the eastern front was the highly developed rail network."■

Field Marshal Erich von Manstein wrote about the importance of rail centers as key terrain in his book, Lost Victories. During the 1942 - 1943 winter campaign in South Russia, both German and Red armies viewed the town of Rostov as key to the survival of German Army Group A, Rumanian 4th Army and 4th Panzer Army. A major Russian goal of Operation Gallop was, by driving west in an attempt to capture Rostov,

to cut off rail communications for those German forces and isolate, at least logistically, the entire southern wing of Hitler's army. The Germans on the other hand, were attempting to hang on to their lifeline, of which Rostov was the center, at least until an evacuation of potentially trapped organizations was complete.**

In areas of the world that are relatively flat, as is the case with much of Western Russia, rail lines can take on added importance. Because the lay of the land is such that no high ground is available to take on military significance, opponents will attempt to seize ground that has importance for reasons other than elevation. That includes vital nodes in transport networks. In cases where fronts are continuous, flanks have to be created by fire and maneuver. In order for these breakthroughs to have a maximum effect upon the enemy, the invading force should target key transportation centers -- and that means rail.

Section Summary

Track and roadbeds are usually not thought of in terms of key terrain, but conditions can arise in war when railroad rights of way assume the characteristics. The degree to which rail is key depends largely upon the value assigned to it by both sides. The United States Army places little emphasis upon rail operations. This is reflected in our small,

military rail capability.²⁷ But our own priorities do not diminish the value that potential adversaries place on rail transportation. We may be able to significantly reduce the enemy's sustainment and maneuver capabilities by taking possession of, or destroying, their key rail centers and lines. Even the little military rail capability we do have might, in certain circumstances, be considered key by our opponents. That may warrant special attention on our part to adequately protect it from enemy intervention.

VII. Conclusion

Railroads should be an influencing factor in planning and executing campaigns. Operational sustainment, maneuver, containment, deception and selection of key terrain are all considerations. Sustainment and maneuver are fundamental concerns for commanders, and this is where rail can make some of its greatest contributions. Certain situational factors may dictate that consideration of railroads in matters of containment, deception and key terrain should be given heavy emphasis.

Today, large unit operations can be carried out only with the massive amounts of petroleum and ammunition which are required to operate modern weapon systems. And other supplies as well must be brought forward to keep support structures functioning. The motor vehicles which are organic to corps

units cannot do the job alone. There are not enough of them to transport the required tonnages. But even if there were sufficient numbers, tactical vehicles are not designed to take the mechanical stress of repeated runs over long distances at high rates of speed. Rail's forte on the other hand, is exactly that.

Rail can also assist theater commanders with operational maneuver. Military forces may be transported in railcars to areas that provide positional advantages over the enemy. Furthermore, unit integrity can be maintained during the movement. Railroads can be used to disperse forces rapidly to deny the enemy a lucrative nuclear target or to mass forces and achieve local superiority at the decisive point. This is an especially important consideration for us since U.S. troops may be fighting outnumbered overall.

Some comparisons can be made between motor and rail transportation. While each mode has its own inherent strengths and weaknesses, rail is much better suited for transporting large numbers of men, equipment and supplies long distances. This contributes to operational agility, a difficult thing to achieve today, given the sheer size of military organizations. Moving large units any substantial distance is difficult by road. Such moves are plagued by traffic congestion, deterioration of the road surface, march column vulnerability, time consuming refueling operations and

maintenance breakdowns. The pros and cons of road marches should be carefully weighed before they are ordered.

Operational containment is a current concept. Through the destruction of enemy railroads, a commander might be able to set the stage for tactical maneuvers which could be decisive. Track and key nodes can be targeted to reduce the opposition's freedom of movement, slowing an enemy force and even fixing it in place. Then appropriate combat power can be brought to bear against the stalled force in the form of operational maneuver, long distance fires or both. But, because damaged roadbeds can be repaired quickly,== interruptions to rail will be brief and therefore must be carefully timed. Even so, attacking rail targets in an opponent's area can cause confusion and disrupt his plans.

Using railroads as part of deception plans is not new. But an argument can be made that, since modern intelligence collection systems are more sophisticated and accurate than ever before, deception plans are more difficult to implement. That may be true, but it does not eliminate the value of deception measures as combat multipliers, if they can be effected. Rail has been successfully used in the past to conceal large troop movements and the transportation of bulk materiel -- key indicators of future courses of action.

Rail lines still can take on the characteristics of key terrain, in certain circumstances. Many countries have developed alternate means of transport, but it has been done

to complement their rail networks, not replace them. Some countries still rely primarily upon railroads to fulfill their transportation needs, while others have no rail capability at all.

Railroads have played a part in campaigns and as history has shown, their role has sometimes been the decisive one. On some occasions, the outcome might have been different without it. Rail's potential contributions today are at least as great. Our military cannot afford to ignore these historic lessons. We should take whatever action is necessary now to ensure that sufficient rail capability is available and deployable when it is needed. And it surely will be needed.

ENDNOTES

ENDNOTES

¹Bradley E. Smith, "The Role of Army Railroading at the Tactical Level of War" (1988): pp. 8 - 11.

²Telephone Interview with Dr. Alfred C. Mierzejewski, Command Historian, TRADOC (Training and Doctrine Command) Test and Experimentation Command (TEXCOM), Fort Hood, Texas, June 27, 1988; Telephone Interview with Major James E. Myers, Deputy, Logistics Assessment Task Group, United States Army Logistics Center, Fort Lee, Virginia, July 8, 1988.

³Strategic Studies Institute, Campaign Planning (1988): p. ix.

⁴Department of the Army, Field Manual 100-5: Operations (1986): pp. 10, 59, 60, 65.

⁵The Strategic Studies Institute of the U.S. Army War College published in 1988 an extensive report entitled, Campaign Planning. Its tenets are listed verbatim below. A campaign plan....(1) Provides broad concepts of operations and sustainment to achieve strategic military objectives in a theater of war. It is the basis for all other planning. (2) Provides an orderly schedule of strategic military decisions -- displays the commander's vision and intent. (3) Orients on the enemy's center of gravity. (Center of gravity is a Clausewitzian term meaning the hub of all power.) (4) Phases a series of related major operations. (5) Composes subordinate forces and designates command relationships. (6) Provides operational direction and tasks to subordinates. (7) Synchronizes air, land and sea efforts into a cohesive and synergistic whole. Strategic Studies Institute, op. cit., p. x.

⁶Department of the Army, Field Manual 100-1: The Army (1986): pp. 13 - 14; Department of the Army, Field Manual 100-5: Operations (1986): p. 10.

⁷Department of the Army, Field Manual 101-5-1: Operational Terms and Symbols (1985): p. 1-13.

⁸Department of Defense, Joint Chiefs of Staff Publication 1: Dictionary of Military and Associated Terms (1987): p. 60.

⁹Edward N. Luttwak, "The Operational Level of War", International Security (Winter 1980 - 1981): pp. 62, 63.

¹⁰Department of the Army, Field Manual 100-5: Operations (1986): p. 10.

¹¹Peter S. Kindsvatter, "An Appreciation for Moving the Heavy Corps: The First Step in Learning the Art of Operational Maneuver" (1986): p. 26.

¹²James A. Van Fleet, Rail Transport and the Winning of Wars (1956): p. 65.

¹³Department of the Army, Field Manual 100-5: Operations (1986): p. 60.

¹⁴Smith, op. cit., pp. 19 - 22.

¹⁵Albin G. Wheeler, "Operational Logistics in Support of the Deep Attack", Military Review (February 1986): p. 18.

¹⁶United States Army Command and General Staff College, Student Text 101-6: G4 Battle Book (1988): pp. 5-6, 5-7, 5-10, 5-13.

¹⁷Smith, op. cit., pp. 19 - 22, 37, 38.

¹⁸Mikhail N. Tukhachevskiy, New Problems in Warfare (1931): p. 49.

¹⁹Bradley E. Smith, "The Role of Army Railroading at the Operational Level of War" (1989): pp. 9 - 16.

²⁰Russell F. Weigley, The American Way of War: A History of United States Military Strategy and Policy (1977): p. 131.

²¹Van Fleet, op. cit., p. 4.

²²Ibid., p. 23.

²³James A. Huston, Army Historical Series: The Sinews of War -- Army Logistics, 1775 - 1953 (1966): pp. 525, 526.

²⁴Christopher R. Gabel, "The Lorraine Campaign: An Overview, September - December 1944" (1985): p. 22.

²⁵A short ton is a unit of weight equivalent to 2,000 pounds. Random House College Dictionary (1980): p. 1383.

²⁶Michael W. Cannon, "Red Ball Express", Armor (May - June 1980): p. 9; Gabel, op. cit., pp. 4, 5; Huston, op. cit., pp. 526, 527.

²⁷Cannon, op. cit., p. 10; Department of the Army, Field Manual 100-5: Operations (1986): p. 60; Huston, op. cit., pp. 527, 528.

²⁸Van Fleet, op. cit., pp. 26, 27.

²⁹Gabel, op. cit., p. 22.

³⁰Bradley E. Smith, "The Role of Army Railroading at the Tactical Level of War" (1988): pp. 19 - 22.

³¹Department of the Army, Field Manual 100-5: Operations (1986): p. 12.

³²Ibid.

³³Michael Howard, The Franco-Prussian War: The German Invasion of France, 1870 - 1871 (1981): pp. 2 - 4.

³⁴Martin Van Creveld, Logistics From Wallenstein to Patton (1984): p. 3.

³⁵P.M. Kalla-Bishop, Future Railways: An Adventure in Engineering (1972): p. 3.

³⁶V.K. Triandafillov, Nature of the Operations of Modern Armies (1929): p. 158.

³⁷Gunther E. Rothenberg, "Moltke, Schlieffen and the Doctrine of Strategic Envelopment", Makers of Modern Strategy (1986): p. 300.

³⁸Edwin J. Arnold and Leonard D. Holder, "Moving the Heavy Division", Military Review (July 1988): p. 35.

³⁹Ibid., p. 36.

⁴⁰Department of the Army, Field Manual 100-5: Operations (1986): p. 16.

⁴¹Lawrence L. Izzo, "An Analysis of Manstein's Winter Campaign on the Russian Front, 1942 - 1943: A Perspective of the Operational Level of War and Its Implications" (1986): pp. 70, 71.

⁴²Peter S. Kindsvatter, "An Appreciation for Moving the Heavy Corps: The First Step in Learning the Art of Operational Maneuver" (1986): p. 31.

⁴³Izzo, loc. cit.

⁴⁴Van Fleet, op. cit., p. 45.

⁴⁵Izzo, op. cit., pp. 69 - 71.

⁴⁶Kindsvatter, op. cit., pp. 27, 28.

⁴⁷Arnold and Holder, op. cit., pp. 37, 39, 48.

- 40Kindsvatter, op. cit., p. 28.
- 41Van Fleet, op. cit., pp. 63, 64.
- 42Hew Strachan, European Armies and the Conduct of War (1985): p. 123.
- 43Kalla-Bishop, op. cit., p. 4.
- 44Izzo, op. cit., p. 70.
- 45Carl R. Gray, Jr., "The Military Railway Service -- Part I", Army Transportation Journal (May - June 1948): p. 18.
- 46Martin Van Creveld, Supplying War (1984): p. 82.
- 47Ibid.; Van Fleet, op. cit., p. 14.
- 48Martin Van Creveld, Command in War (1985): pp. 103 - 147; Martin Van Creveld, Supplying War (1984): pp. 91, 92.
- 49Martin Van Creveld, Command in War (1985): p. 106.
- 50Ibid.
- 51Michael I. Handel, Clausewitz and Modern Strategy (1986): pp. 54, 55.
- 52Alfred Vagts, Defense and Diplomacy: The Soldier and the Conduct of Foreign Relations (1956): p. 379.
- 53Correlli Barnett, The Swordbearers: Supreme Command in the First World War (1975): pp. 3, 4, 16, 22, 23; Martin Van Creveld, Supplying War (1984): pp. 115 - 118.
- 54Barnett, op. cit., p. 77.
- 55Ibid., p. 96.
- 56Ibid., p. 60.
- 57Ibid., pp. 7, 18.
- 58Ibid., p. 25.
- 59Ibid., p. 64; Martin Van Creveld, Supplying War (1984): pp. 118 - 122.
- 60James A. Van Fleet, Rail Transport and the Winning of Wars (1956): p. 30.

69B.H. Friesen, "Breakout From the Veszprem Railhead", Armor (January - February 1988): pp. 20, 21.

70Mikhail N. Tukhachevskiy, New Problems in Warfare (1931): p. 7.

71Ibid., p. 9.

72Ibid., p. 2.

73Bradley E. Smith, "The Role of Army Railroading at the Tactical Level of War" (1988): pp. 11 - 16.

74Denis Bishop and W.J.K. Davies, Railways and War Since 1917 (1974): pp. 108, 109.

75Ibid., p. 107.

76David M. Glantz, "The Red Mask: The Nature and Legacy of Soviet Military Deception in the Second World War", Intelligence and National Security (July 1987): pp. 231 - 238, 242.

77Key terrain is "any locality, or area, the seizure or retention of which affords a marked advantage to either combatant". Department of Defense, Joint Chiefs of Staff Publication 1: Dictionary of Military and Associated Terms (1987): p. 203.

78Edward N. Luttwak, "The Operational Level of War", International Security (Winter 1980 - 1981): p. 62.

79"Russia and the Soviet Union, History of", Encyclopaedia Britannica, Volume 16 (1984): p. 66.

80Bruce W. Menning, "Bayonets Before Bullets: The Organization and Tactics of the Imperial Russian Army, 1861 - 1905" (1984): p. 175.

81Ibid., pp. iii, 175, 193, 194.

82Lynn Montross, War Through the Ages (1960): pp. 671 - 680; Edwin A. Pratt, The Rise of Rail Power: In War and Conquest, 1833 - 1914 (1916): pp. 260 - 276. Russia was dependent on the Trans-Siberian Railroad (which terminated at Vladivostok) and the Chinese Eastern Railroad (which intersected the Trans-Siberian and terminated at Port Arthur) for the strategic and operational movement of her forces. No other means of mass transportation was available in Eastern Russia. Pratt, op. cit., p. 262. Reliance upon these rail lines can be equally great today. Research at the U.S. Army Institute for Advanced Russian and East European Studies has

concluded that, "In the event of a Sino-Soviet War, the Trans-Siberian Railroad will be the backbone of logistics support just as it was during the Russo-Japanese War in 1945....In order to weaken the Soviets significantly, the Chinese would have to cut the Trans-Siberian Railroad and prevent the use of battle railroads." Robert C. Rhodes, "Soviet Fuel Supply Capabilities During a Sino-Soviet War" (1977): pp. 7, 15.

■3Archibald P. Wavell, The Palestine Campaigns (1929): pp. 198, 199, 230, 231.

■4Thomas E. Lawrence, Seven Pillars of Wisdom (1935): pp. 463, 518, 551.

■5Ron Ziel, Steel Rails to Victory: A Photographic History of Railway Operations During World War II (1970): p. 49.

■6Erich Von Manstein, Lost Victories (1985): pp. 367 - 375.

■7Smith, op. cit., pp. 29 - 33.

■8Ibid., pp. 11 - 16.

BIBLIOGRAPHY

BIBLIOGRAPHY

Books

Barnett, Correlli. The Swordbearers: Supreme Command in the First World War. 3rd ed. Bloomington: Indiana University Press, 1975.

Bishop, Denis and Davies, W.J.K. Railways and War Since 1917. 1st ed. London: Blandford Press, 1974.

Handel, Michael I. Clausewitz and Modern Strategy. 1st ed. Totowa: Frank Cass and Company Limited, 1986.

Howard, Michael. The Franco-Prussian War: The German Invasion of France, 1870 - 1871. 3rd ed. New York: Methuen and Company, 1981.

Kalla-Bishop, P.M. Future Railways: An Adventure in Engineering. 1st ed. London: IPC Transport Press Ltd., 1972.

Lawrence, Thomas E. Seven Pillars of Wisdom. 2nd ed. New York: Viking Penguin, Inc., 1935.

Manstein, Erich Von. Lost Victories. 5th ed. Translated by Anthony G. Powell. Novato: Presidio Press, 1985.

Montross, Lynn. War Through the Ages. 3rd ed. New York: Harper and Row, Publishers, 1960.

Pratt, Edwin A. The Rise of Rail Power: In War and Conquest, 1833 - 1914. 1st ed. Philadelphia: J.B. Lippincott Company, 1916.

Random House College Dictionary. 1st ed. New York: Random House, Inc., 1980.

Rothenberg, Gunther E. "Mo' ke, Schlieffen and the Doctrine of Strategic Envelopment." Makers of Modern Strategy. 2nd ed. Princeton: Princeton University Press, 1986.

"Russia and the Soviet Union, History of." Encyclopaedia Britannica. 15th ed. Volume 16. Chicago: Helen Hemingway Benton, Publisher, 1984.

Strachan, Hew. European Armies and the Conduct of War. 4th ed. London: George Allen and Unwin, 1985.

Triandafillov, V.K. Nature of the Operations of Modern Armies. 1st ed. Translated by William A. Burhans. Woodbridge: Russian-English Translations, Inc., 1929.

Tukhachevskiy, Mikhail N. New Problems in Warfare. 1st ed. Translated by the United States Army War College. Carlisle Barracks: The United States Army War College, 1931.

Vagts, Alfred. Defense and Diplomacy: The Soldier and the Conduct of Foreign Relations. 1st ed. New York: Kings Crown Press, 1956.

Van Creveld, Martin. Command in War. 1st ed. Cambridge: Harvard University Press, 1985.

Van Creveld, Martin. Logistics From Wallenstein to Patton. 6th ed. Cambridge: Cambridge University Press, 1984.

Van Creveld, Martin. Supplying War. 6th ed. Cambridge: Cambridge University Press, 1984.

Van Fleet, James A. Rail Transport and the Winning of Wars. 1st ed. Washington, D.C.: Association of American Railroads, 1956.

Wavell, Archibald P. The Palestine Campaigns. 2nd ed. London: Constable and Company, Limited, 1929.

Weigley, Russell F. The American Way of War: A History of United States Military Strategy and Policy. 2nd ed. Bloomington: Indiana University Press, 1977.

Ziel, Ron. Steel Rails to Victory: A Photographic History of Railway Operations During World War II. 1st ed. New York: Hawthorn Books, Inc., 1970.

Government Publications

Department of Defense. Joint Chiefs of Staff Publication 1: Dictionary of Military and Associated Terms. Washington, D.C.: Department of Defense, 1987.

Department of the Army. Field Manual 100-1: The Army. Washington, D.C.: Department of the Army, 1986.

Department of the Army. Field Manual 100-5: Operations. Washington, D.C.: Department of the Army, 1986.

Department of the Army. Field Manual 101-5-1: Operational Terms and Symbols. Washington, D.C.: Department of the Army, 1985.

Huston, James A. Army Historical Series: The Sinews of War -- Army Logistics, 1775 - 1953. Washington, D.C.: Department of the Army, 1966.

Strategic Studies Institute. Campaign Planning. Carlisle Barracks: The United States Army War College, 1989.

United States Army Command and General Staff College. Student Text 101-6: G4 Battle Book. Fort Leavenworth: The United States Army Command and General Staff College, 1988.

Interviews

Mierzejewski, Alfred C., PhD. Telephone Interview with the Command Historian, TRADOC (Training and Doctrine Command) Test and Experimentation Command (TEXCOM), Fort Hood, Texas, June 27, 1988.

Myers, James E., Major, United States Army. Telephone Interview with the Deputy, Logistics Assessment Task Group, United States Army Logistics Center, Fort Lee, Virginia, July 8, 1988.

Periodicals

Arnold, Edwin J. and Holder, Leonard D. "Moving the Heavy Division." Military Review, July 1988.

Cannon, Michael W. "Red Ball Express." Armor, May - June 1980.

Friesen, B.H. "Breakout From the Veszprem Railhead." Armor, January - February 1988.

Glantz, David M. "The Red Mask: The Nature and Legacy of Soviet Military Deception in the Second World War." Intelligence and National Security, July 1987.

Gray, Carl R., Jr. "The Military Railway Service -- Part I." Army Transportation Journal, May - June 1948.

Luttwak, Edward N. "The Operational Level of War." International Security, Winter 1980 - 1981.

Wheeler, Albin G. "Operational Logistics in Support of the Deep Attack." Military Review, February 1986.

Special Reports and Studies

Gabel, Christopher R. "The Lorraine Campaign: An Overview, September - December 1944." Fort Leavenworth: The Command and General Staff College, 1985.

Izzo, Lawrence L. "An Analysis of Manstein's Winter Campaign on the Russian Front, 1942 - 1943: A Perspective of the Operational Level of War and Its Implications." Fort Leavenworth: The School of Advanced Military Studies, 1986.

Kindsvatter, Peter S. "An Appreciation for Moving the Heavy Corps: The First Step in Learning the Art of Operational Maneuver." Fort Leavenworth: The School of Advanced Military Studies, 1986.

Menning, Bruce W. "Bayonets Before Bullets: The Organization and Tactics of the Imperial Russian Army, 1861 - 1905." Fort Leavenworth: The Command and General Staff College, 1984.

Rhodes, Robert C. "Soviet Fuel Supply Capabilities During a Sino-Soviet War." Garmisch: United States Army Institute for Advanced Russian and East European Studies, 1977.

Smith, Bradley E. "The Role of Army Railroading at the Tactical Level of War." Fort Leavenworth: The School of Advanced Military Studies, 1988.

Smith, Bradley E. "The Role of Army Railroading at the Operational Level of War." Fort Leavenworth: The School of Advanced Military Studies, 1989.

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